μA709

HIGH PERFORMANCE OPERATIONAL AMPLIFIER

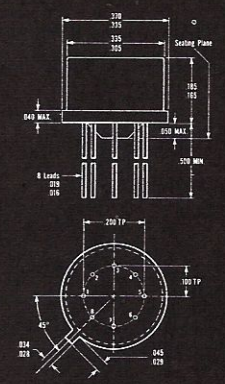
FAIRCHILD LINEAR INTEGRATED CIRCUITS

GENERAL DESCRIPTIONS - The μA709 is a high-gain operational amplifier constructed on a single silicon chip using the Fairchild Planar epitaxial process. It features low offset, high input impedance, large input common mode range, high output swing under load and low power consumption. The device displays exceptional temperature stability and will operate over a wide range of supply voltages with little degradation of performance. The amplifier is intended for use in DC servo systems, high impedance analog computers, in low-level instrumentation applications and for the generation of special linear and nonlinear transfer functions.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage		± 18 V
Internal Power Dissipation	(Note 1)	300 mW
Differential Input Voltage		± 5.0 V
Input Voltage		± 10 V
Output Short-Circuit Duration	(T_A = 25°C)	5 sec
Storage Temperature Range		-65°C to + 150°C
Operating Temperature Range		-55°C to + 125°C
Lead Temperature (Soldering, 60 sec)		300°C

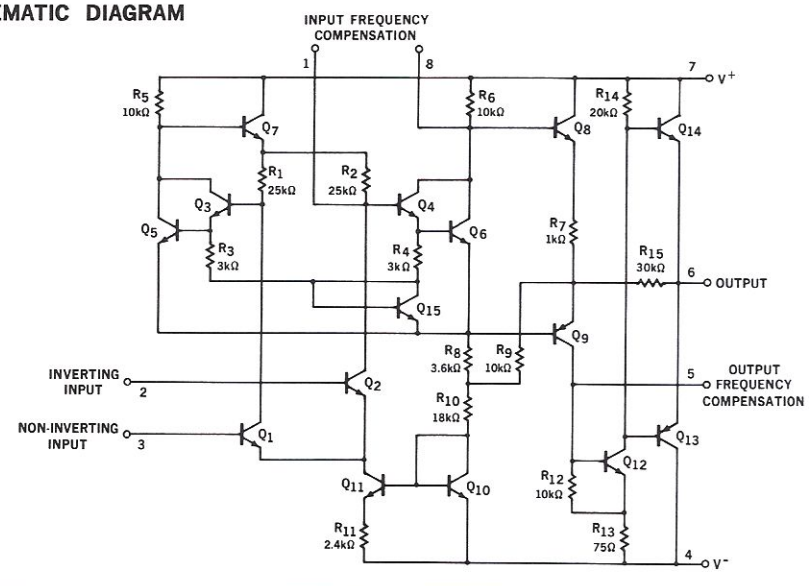
PHYSICAL DIMENSIONS
(SIMILAR TO TO-5)



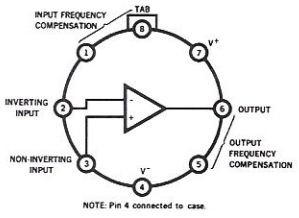
NOTES: Dimensions as per latest JS-10 committee.
All dimensions in inches.
Leads are gold-plated kovar.
Package weight is 1.12 grams.

ORDER PART NO.
U5B770931X

SCHEMATIC DIAGRAM



CONNECTION DIAGRAM



(Top View)

NOTE 1: Rating applies for case temperatures to + 125°C; derate linearly at 5.6 mW/°C for ambient temperatures above + 95°C.

313 FAIRCHILD DRIVE, MOUNTAIN VIEW, CALIFORNIA, (415) 962-5011, TWX: 910-379-6435

FAIRCHILD SEMICONDUCTOR
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

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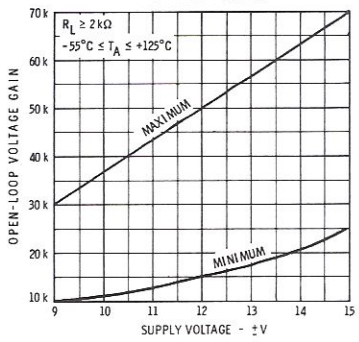
ELECTRICAL CHARACTERISTICS (T_A = +25°C, ±9 V ≤ V_S ≤ ±15 V unless otherwise specified)

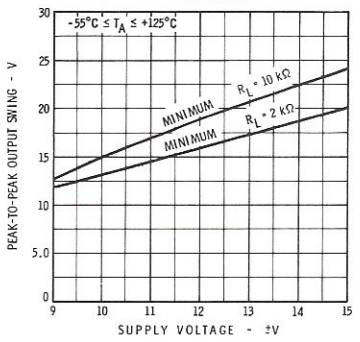
Parameter (see definitions)	Conditions	Min.	Typ.	Max.	Units
Input Offset Voltage	$R_S \leq 10\,k\Omega$		1.0	5.0	mV
Input Offset Current			50	200	nA
Input Bias Current			200	500	nA
Input Resistance		150	400		kΩ
Output Resistance			150		Ω
Power Consumption	V_S = ±15 V		80	165	mW
Transient Response	V_{in} = 20 mV, R_L = 2 kΩ,				
Risetime	C_1 = 5000 pF, R_1 = 1.5 kΩ, C_2 = 200 pF, R_2 = 50 Ω		0.3	1.0	μs
Overshoot	$C_L \leq 100$ pF		10	30	%
The following specifications apply for -55°C ≤ T_A ≤ +125°C:					
Input Offset Voltage	$R_S \leq 10$ kΩ			6.0	mV
Average Temperature Coefficient of Input Offset Voltage	R_S = 50 Ω		3.0		μV/°C
	$R_S \leq 10$ kΩ		6.0		μV/°C
Large-Signal Voltage Gain	V_S = ±15 V, $R_L \geq 2$ kΩ, V_{out} = ±10 V	25,000	45,000	70,000	
Output Voltage Swing	V_S = ±15 V, $R_L \geq 10$ kΩ	±12	±14		V
	V_S = ±15 V, $R_L \geq 2$ kΩ	±10	±13		V
Input Voltage Range	V_S = ±15 V	±8.0	±10		V
Common Mode Rejection Ratio	$R_S \leq 10$ kΩ	70	90		dB
Supply Voltage Rejection Ratio	$R_S \leq 10$ kΩ		25	150	μV/V
Input Offset Current	T_A = +125°C		20	200	nA
	T_A = -55°C		100	500	nA
Input Bias Current	T_A = -55°C		0.5	1.5	μA
Input Resistance		40	100		kΩ

GUARANTEED ELECTRICAL CHARACTERISTICS

VOLTAGE GAIN

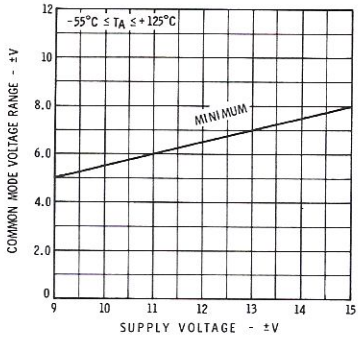


OUTPUT VOLTAGE SWING

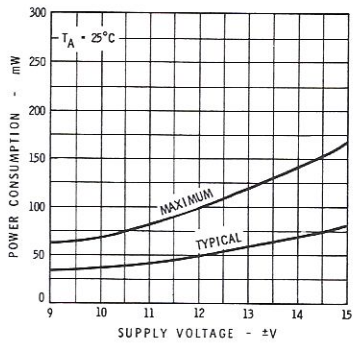


GUARANTEED ELECTRICAL CHARACTERISTICS (CONT'D)

INPUT COMMON MODE VOLTAGE RANGE

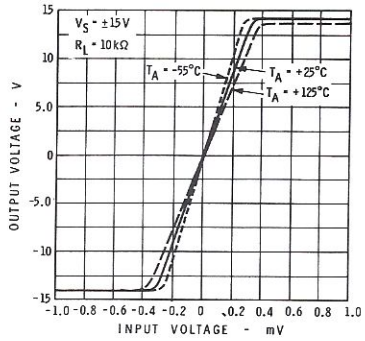


POWER CONSUMPTION

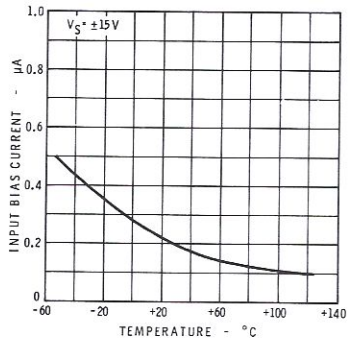


TYPICAL PERFORMANCE CURVES

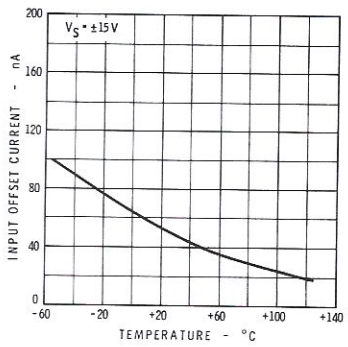
VOLTAGE TRANSFER CHARACTERISTIC



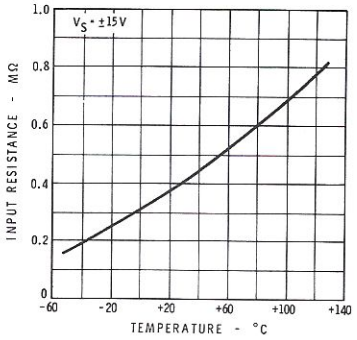
INPUT BIAS CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE



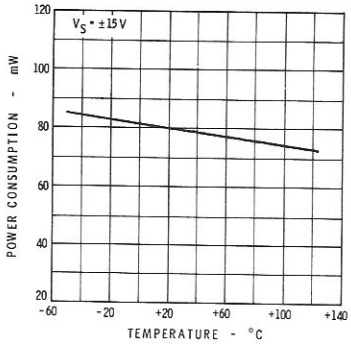
INPUT OFFSET CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE



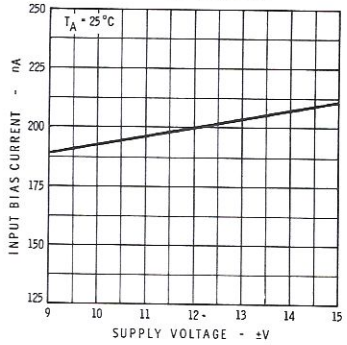
INPUT RESISTANCE AS A FUNCTION OF AMBIENT TEMPERATURE



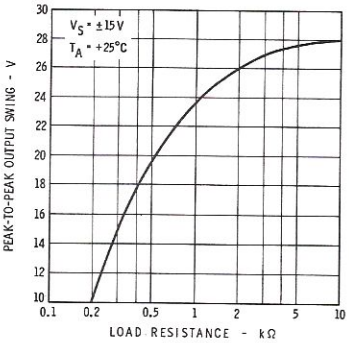
POWER CONSUMPTION AS A FUNCTION OF AMBIENT TEMPERATURE



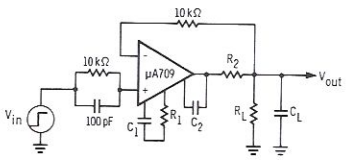
INPUT BIAS CURRENT AS A FUNCTION OF SUPPLY VOLTAGE



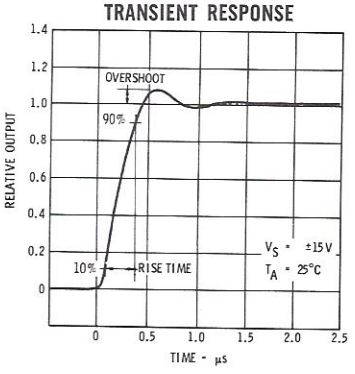
OUTPUT VOLTAGE SWING AS A FUNCTION OF LOAD RESISTANCE



TRANSIENT RESPONSE TEST CIRCUIT



TRANSIENT RESPONSE



DEFINITION OF TERMS

INPUT OFFSET VOLTAGE - That voltage which must be applied between the input terminals to obtain zero output voltage. The input offset voltage may also be defined for the case where two equal resistances are inserted in series with the input leads.

INPUT OFFSET CURRENT - The difference in the currents into the two input terminals with the output at zero volts.

INPUT RESISTANCE - The resistance looking into either input terminal with the other grounded.

INPUT BIAS CURRENT - The average of the two input currents.

INPUT VOLTAGE RANGE - A range of voltage which, if exceeded on either input terminal, could cause the amplifier to cease functioning properly.

INPUT COMMON MODE REJECTION RATIO - The ratio of the input voltage range to the maximum change in input offset voltage over this range.

LARGE-SIGNAL VOLTAGE GAIN - The ratio of the maximum output voltage swing with load to the change in input voltage required to drive the output from zero to this voltage.

OUTPUT VOLTAGE SWING - The peak output swing, referred to zero, that can be obtained without clipping.

OUTPUT RESISTANCE - The resistance seen looking into the output terminal with the output at null. This parameter is defined only under small signal conditions at frequencies above a few hundred cycles to eliminate the influence of drift and thermal feedback.

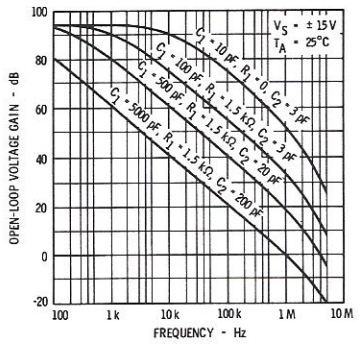
POWER CONSUMPTION - The DC power required to operate the amplifier with the output at zero and with no load current.

SUPPLY VOLTAGE REJECTION RATIO - The ratio of the change in input offset voltage to the change in supply voltage producing it.

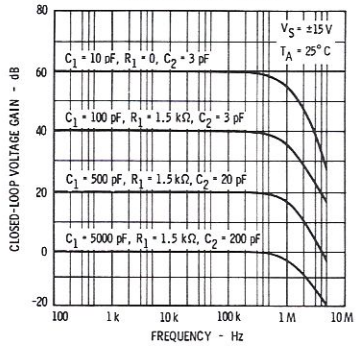
TRANSIENT RESPONSE - The closed-loop step function response of the amplifier under small-signal conditions.

TYPICAL PERFORMANCE CURVES

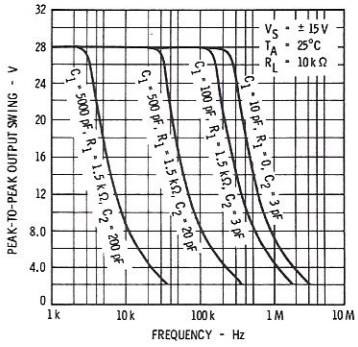
OPEN-LOOP FREQUENCY RESPONSE FOR VARIOUS VALUES OF COMPENSATION


OPEN-LOOP VOLTAGE GAIN - dB
FREQUENCY - Hz
V_S = ±15V
T_A = 25°C
C_1 = 10 pF, R_1 = 0, C_2 = 3 pF
C_1 = 100 pF, R_1 = 1.5 kΩ, C_2 = 3 pF
C_1 = 500 pF, R_1 = 1.5 kΩ, C_2 = 20 pF
C_1 = 5000 pF, R_1 = 1.5 kΩ, C_2 = 200 pF

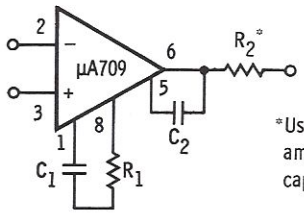
FREQUENCY RESPONSE FOR VARIOUS CLOSED-LOOP GAINS


CLOSED-LOOP VOLTAGE GAIN - dB
FREQUENCY - Hz
V_S = ±15V
T_A = 25°C
C_1 = 10 pF, R_1 = 0, C_2 = 3 pF
C_1 = 100 pF, R_1 = 1.5 kΩ, C_2 = 3 pF
C_1 = 500 pF, R_1 = 1.5 kΩ, C_2 = 20 pF
C_1 = 5000 pF, R_1 = 1.5 kΩ, C_2 = 200 pF

OUTPUT VOLTAGE SWING AS A FUNCTION OF FREQUENCY FOR VARIOUS COMPENSATION NETWORKS


PEAK-TO-PEAK OUTPUT SWING - V
FREQUENCY - Hz
V_S = ±15V
T_A = 25°C
R_L = 10kΩ
C_1 = 10 pF, R_1 = 0, C_2 = 3 pF
C_1 = 100 pF, R_1 = 1.5 kΩ, C_2 = 3 pF
C_1 = 500 pF, R_1 = 1.5 kΩ, C_2 = 20 pF
C_1 = 5000 pF, R_1 = 1.5 kΩ, C_2 = 200 pF

FREQUENCY COMPENSATION CIRCUIT



*Use R_2 = 50 Ω when the amplifier is operated with capacitive loading.

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